

## RG 2000 – the New Gravity System of Sweden

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**Key words:** Reference frames; Reference systems; Gravity system

### SUMMARY

We present the new gravity system RG 2000 for Sweden, including its realization through a combination of absolute gravity observations and network of relative observations. The main motivation for the work is the increased need for improved geoid models from GNSS height determination, which calls for additional gravity observations and quality assurance of existing data. In this perspective, a new modern gravity system and the renovation of the high order gravity network is considered as a moderate strategic investment which provides a firm foundation for further activities.

The previous Swedish gravity system, RG 82, was based on four absolute gravity observations in Scandinavia in 1976 by the Italian absolute gravimeter IMGIC. Although the gravity level of this system in land uplift epoch 1982.0 agrees surprisingly well to RG 2000 (some 30  $\mu\text{Gal}$  difference), a considerable improvement is possible with modern instruments. The ongoing glacial isostatic adjustment in Fennoscandia influences all geodetic reference systems over time and make the epoch essential. The epoch of RG 2000 is 2000.0, which corresponds well with the epochs of the national height system, RH 2000 and the national 3D system, SWEREF 99

In the autumn of 2006 Lantmäteriet in Sweden purchased the absolute gravimeter FG5-233 and has since the spring of 2007 observed the absolute gravity at 13 sites in Sweden with the highest possible accuracy to date. The scientific purpose is to study the gravity change due to glacial isostatic adjustment. However, these stations will also form a firm base for the new gravity system and its realization.

The RG 2000 project started in 2011 with the first field campaign using the portable absolute gravimeter A10-020, owned by IGIK in Poland. During totally five field campaigns from 2011 to

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2015, 95 points were measured with that instrument. Almost half of the points were previously used in RG 82 or the even older RG 62, which means that good connections between the systems have been established. In addition, two points were measured with the absolute gravimeter A10-019 owned by DTU Space in Denmark. All the still available points in the first two orders of the RG 82 gravity network were added to the new network by using relative observations from 1975 to 2002 and new observations from 2013 to 2017 to connect them to the FG5 and new A10 points. Epoch reduction of the gravity observations was done using the land uplift model NKG2016LU, which is a product of the joint work of the Nordic Geodetic Commission (NKG) and gives a linear relation between land uplift and gravity change. The adjustment was performed with the software Gad (Gravity adjustment), developed in-house by Lantmäteriet. Finally it should be mentioned that RG 2000 is a zero tide system.

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